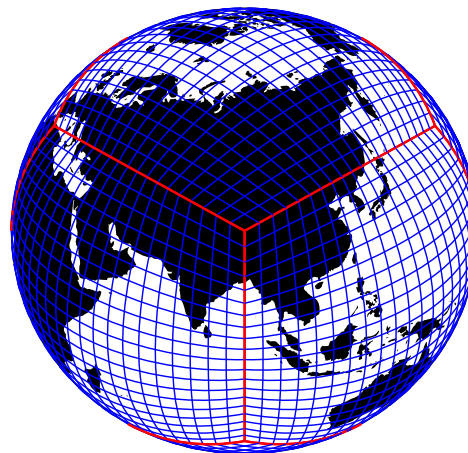


Update/Plans on High resolution Atmospheric Modeling

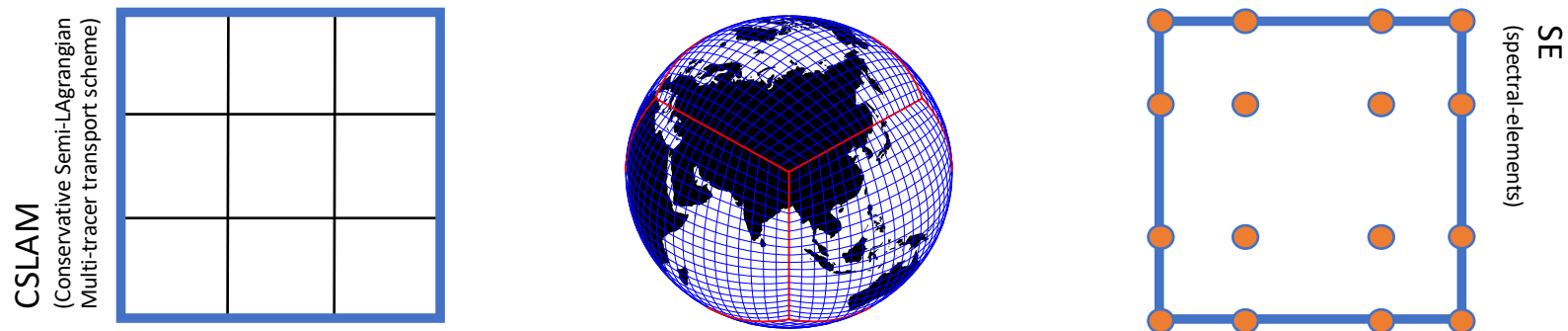


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Where are we now: CESM2.1 release (CMIP6 1degree)

- CAM6 final physics configuration being released with finite-volume dynamical core (1 degree horizontal resolution) - **NOW**
- The spectral-element dynamical core has undergone major science developments and code optimization; in particular, the CAM-SE-CSLAM configuration (CESM2.2 release):

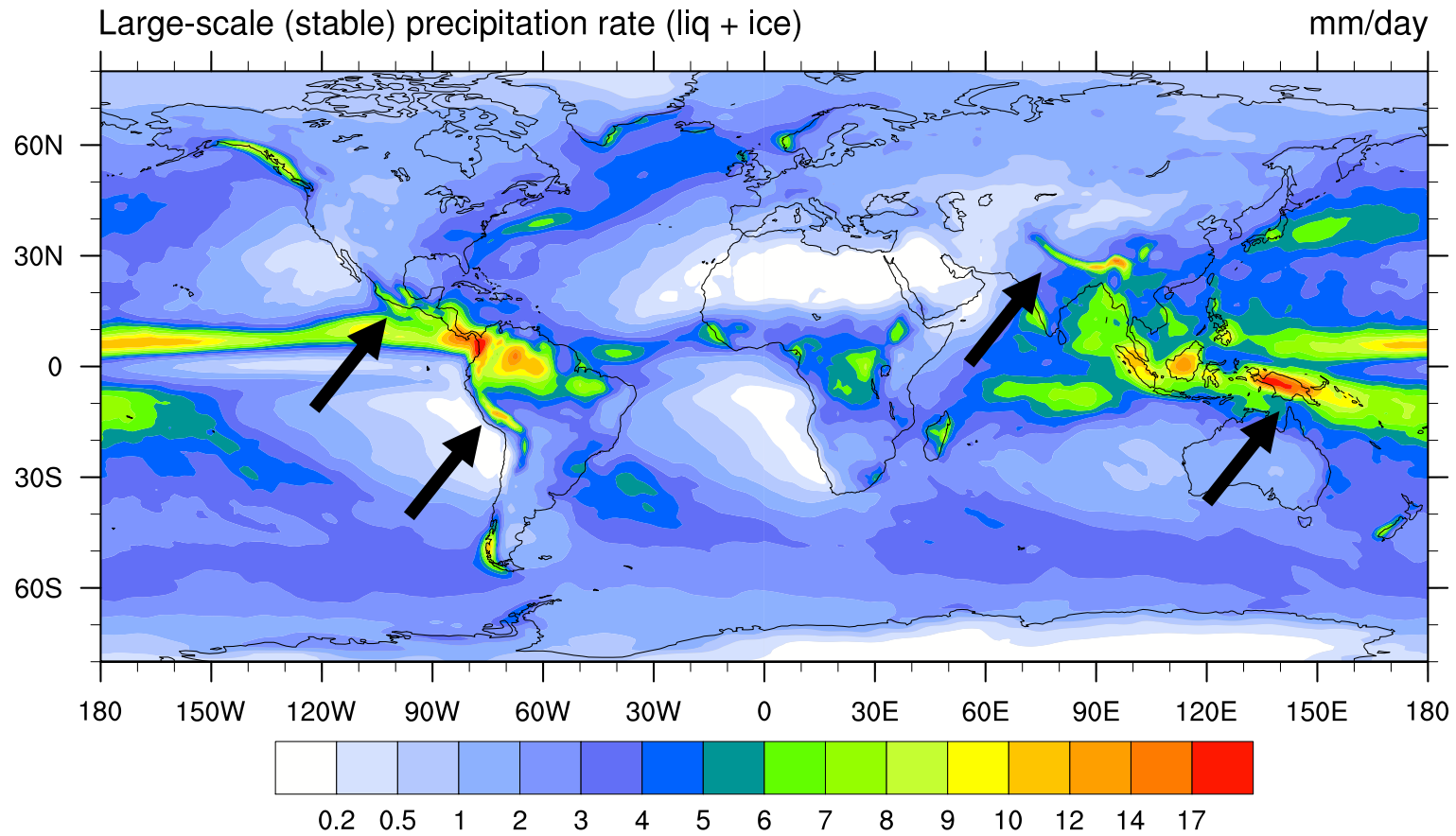


<http://www.cgd.ucar.edu/cms/pel/papers/HetAI2018MWR.pdf>

Note: CAM-SE-CSLAM does not currently support mesh-refinement (could be done if we decide to)

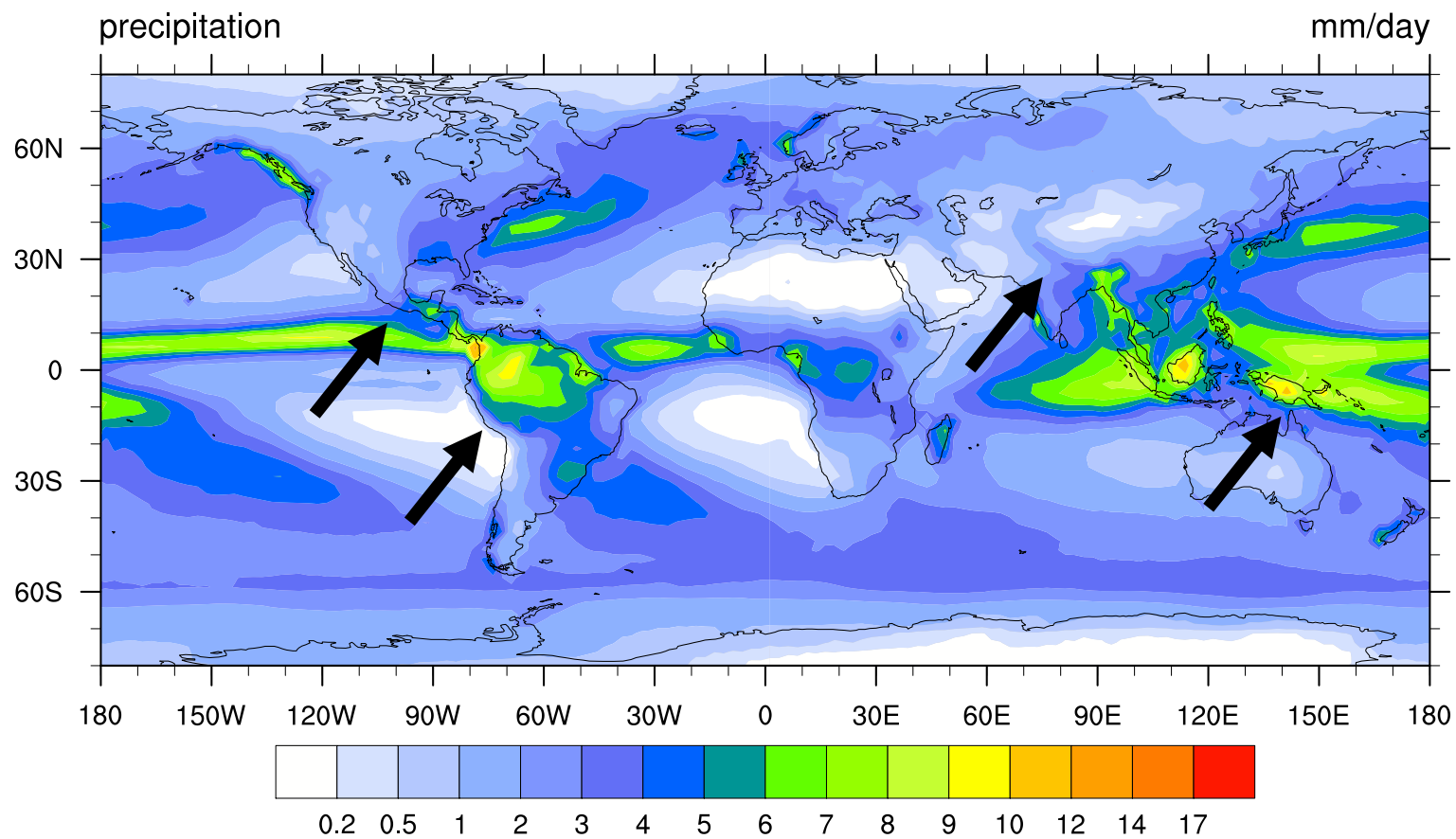
AMIP simulation (1 degree)

CAM-FV, ANN PRECT



CAM6 release physics, only 3 year average

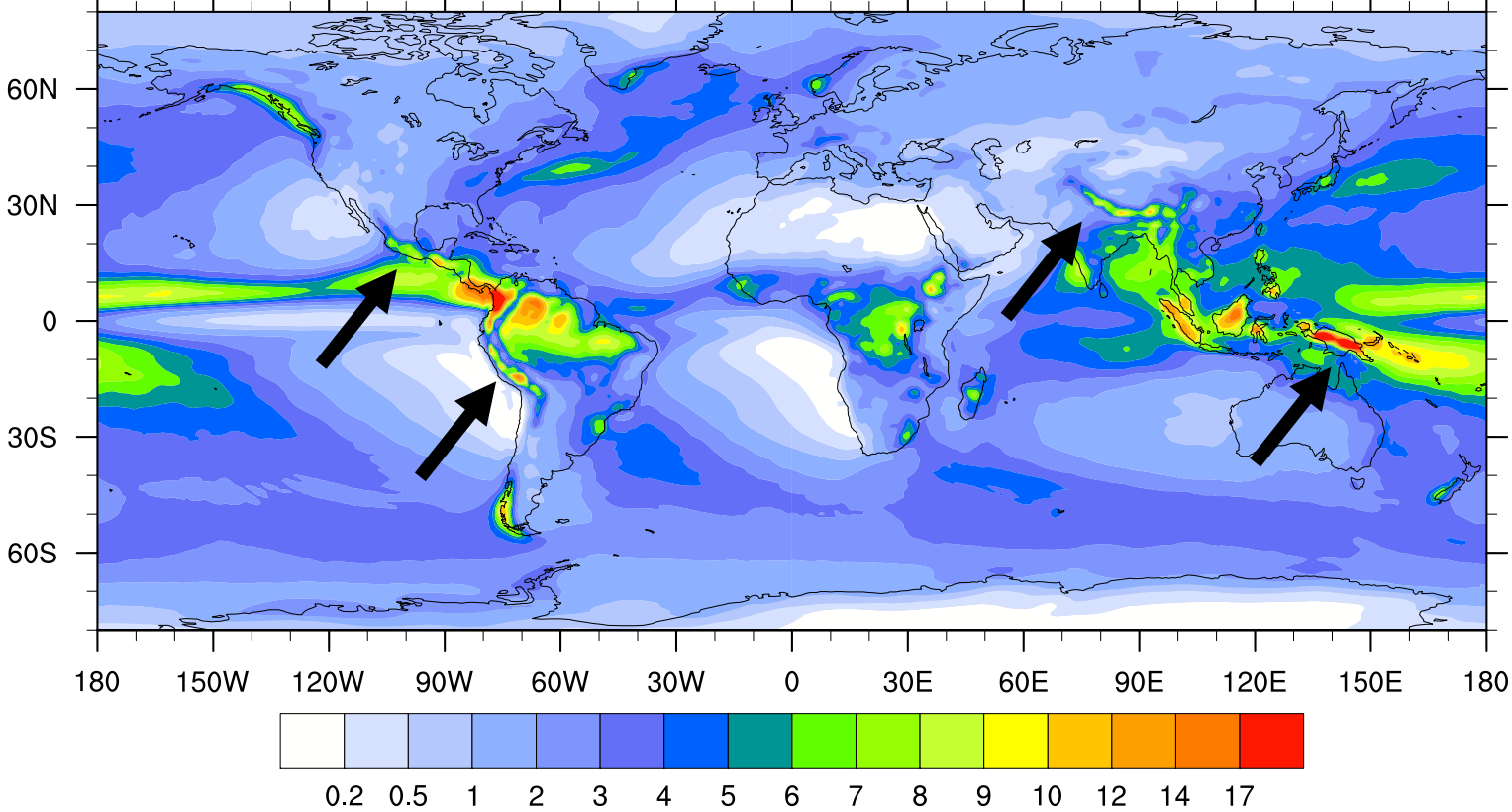
GPCP ANN



AMIP simulation (1 degree)

CAM-SE, C60 topo, ANN PRECT, 16.5yrs ave

Large-scale (stable) precipitation rate (liq + ice) mm/day

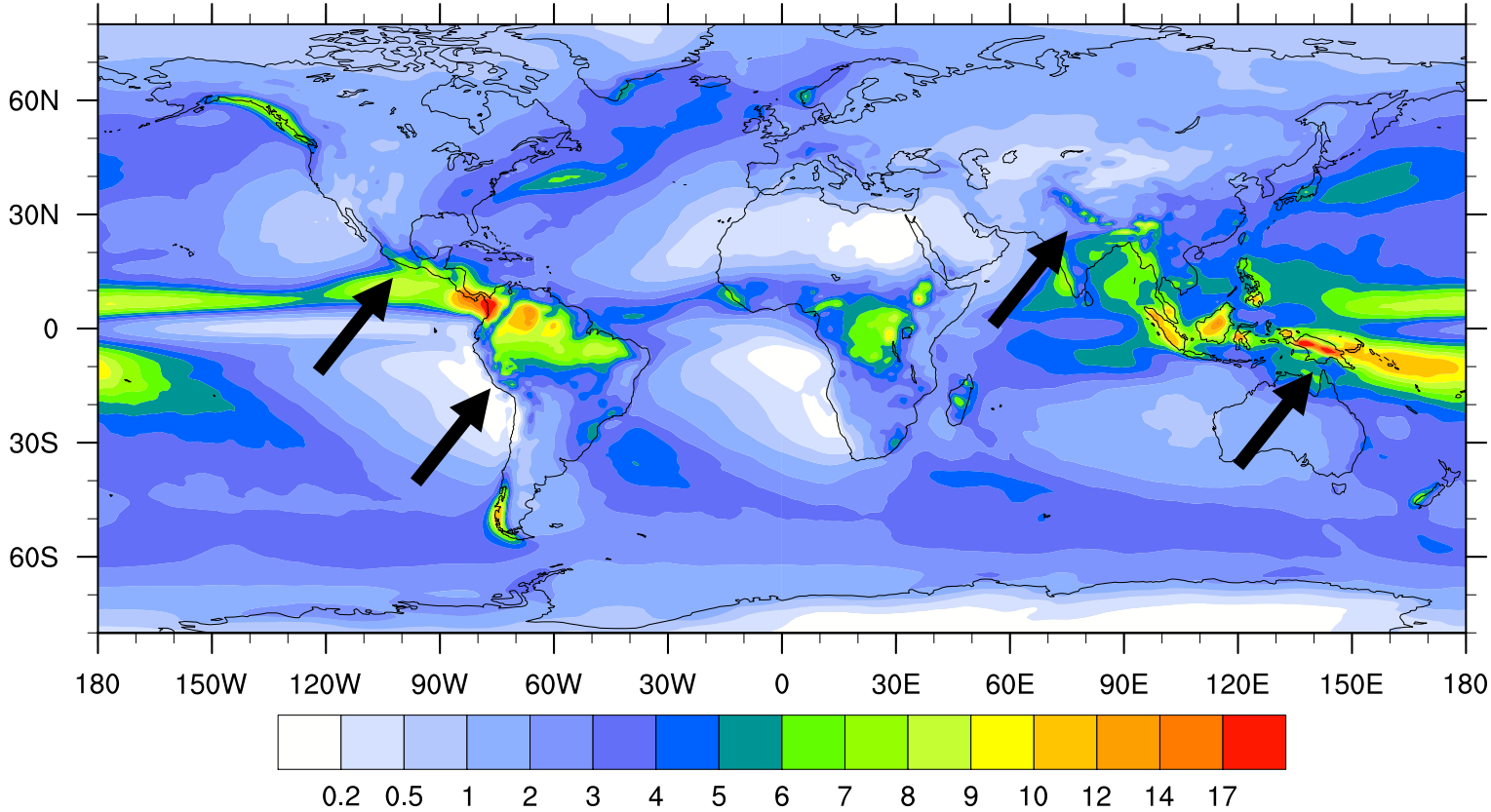


CAM6 release physics

AMIP simulation (1 degree)

CAM-SE-CSLAM, C60 topo, ANN PRECT, 16.5yrs ave

Large-scale (stable) precipitation rate (liq + ice) mm/day



CAM6 release physics

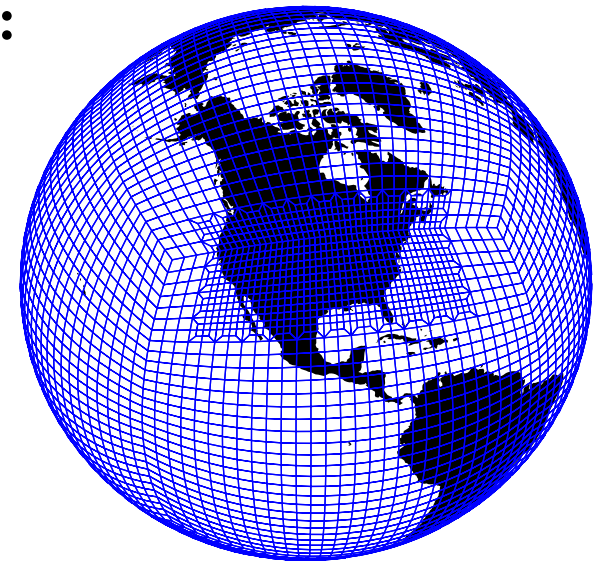
Moving forward: immediate future (low resolution)

- **There is a need to replace the finite-volume dynamical core:**
 - over 2 decades old (not being developed further)
 - not scalable

That said, none of the scalable dynamical cores can match FV throughput at lower core counts (< 1500)!
- **Switch to CAM-SE-CSLAM for 1 degree applications**
(CAM, WACCM, CAM-Chem, WACCM-x)
 - > still some work to be done for WACCM and WACCM-x
- **CAM-SE-CSLAM will be our new baseline**
(only scalable dynamical core currently supported in CESM)

Moving forward: immediate future (high resolution)

- **“High resolution MIP”**: 1/4 degree CAM-SE-CSLAM with companion 1 degree CAM-SE-CSLAM simulations
(AMIP only)
- **Configure mesh-refinement versions of CAM-SE:**
 - CONUS (CESM2.2 release)
 - Arctic (for “Navigating the New Arctic”, NSF 10 Big Ideas)



Moving forward: soon-ish

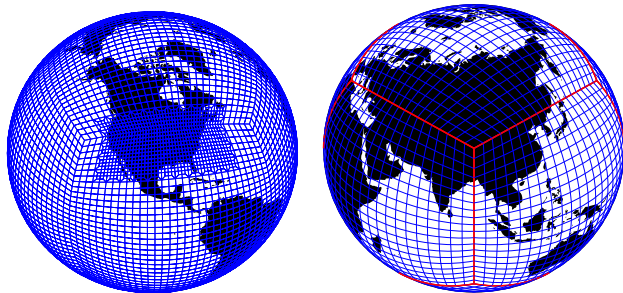
- **FV3 being implemented into CESM**
(close to having AMIP configuration running; funded by NOAA)
- **Plans to integrate MPAS into CESM** (through SIMA)

-> this will give us non-hydrostatic capability in CESM for very high resolution

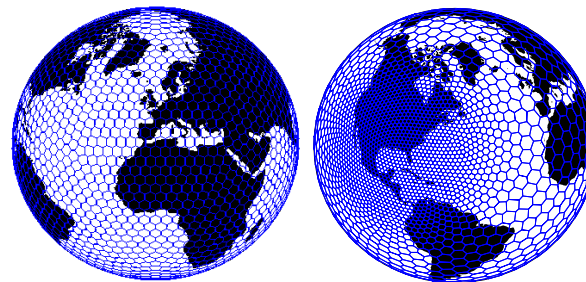
AMWG is planning to compare FV3, MPAS and SE-CSLAM for “standard” CAM applications (1 degree)

https://acomstaff.acom.ucar.edu/singletrack/Documents/Singletrack_Dynamical_Core_Requirements.pdf

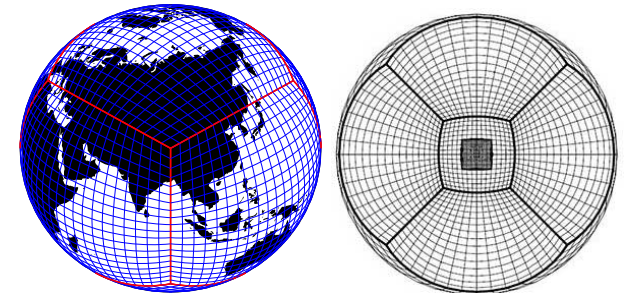
CAM-SE(CSLAM)



CAM-MPAS



CAM-FV3



Moving forward: soon-ish

- FV3 being implemented into CESM
(close to having AMIP configuration running; funded by NOAA)
- Plan

-> this

AMW
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<https://acc>

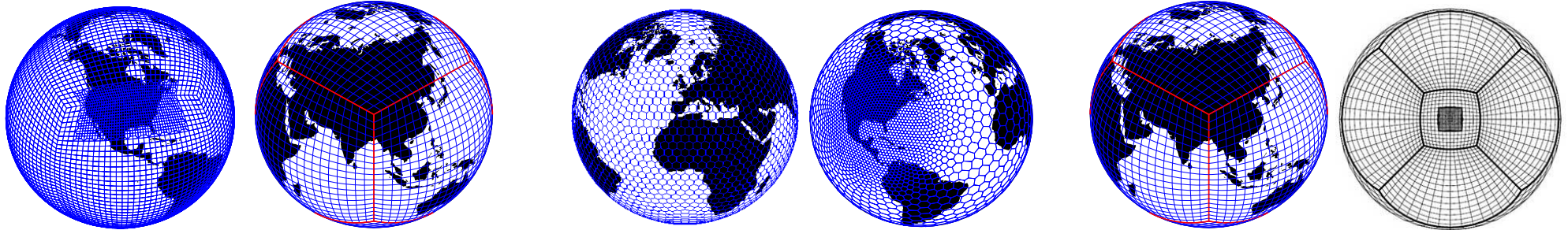
That said, none of these dynamical cores provide deep atmosphere modeling capability for WACCM-x

gh resolution

M for

CAM

CAM-FV3



Moving forward: Beyond immediate future

- **Physics development:**

Discussion with community (AMWG) has been initiated

**SIMA will provide capabilities that may be of interest to CAM
(access to "weather" physics parameterizations)**

**=> Many basic research questions: scale-aware parameterizations,
energy budget (missing terms?), grey zone, 3D radiation, ...**

- **Getting CAM better suited for forecasting? (streamlining creation of datasets, reduce start-up cost, re-arrange CAM's time loop)**

